Guidelines for Gold Assaying and Hallmarking Centres

Central Pollution Control Board
(Ministry of Environment, Forest and Climate Change, Govt of India)
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Environmental Guidelines for Gold Assaying and Hallmarking Centres

Background:

An Original application (OA) No. 568/2019, James Jose, Managing Director, CGR Hall markers Pvt. Ltd. vs Govt. of India was filed in the Hon'ble NGT highlighting the air pollution caused by acidic fumes in gold hallmarking centres from the process of Gold Assaying and Hallmarking without complying the pollution control norms. Hon'ble NGT vide its order dated 18.11.2019 directed *CPCB to "update the existing guidelines in the matter so that environmental norms are met in the process"*. There is no existing environmental guidelines prepared by CPCB for Gold Hallmarking Centres. These Hallmarking centres are BIS certified under the provision of Indian standard IS 15820:2009.

In compliance of Hon'ble NGT order, CPCB has framed Environmental Guidelines to bring such facilities into the environmental regulatory framework.

2.0 Hallmarking:

The BIS (Bureau of Indian Standards) Hallmark is a certifying mechanism to certify the purity of precious metals jewellery viz. gold and silver, sold in India. The testing and marking of the jewellery is done in BIS certified Assaying & Hallmarking centres across the country. BIS has framed & published the "Guideline (HM/A&HC/Guidelines/2, September,2018)" for recognition and operation of hallmarking centres. BIS guidelines stipulate the procedures for grant, operation, renewal, suspension and cancellation of recognition of Assaying and Hallmarking (A &H) Centers. Indian standard IS 15820:2009 is the basis for recognition of assaying and hallmarking centers, which specifies a Fire Assay test for Assay and Hallmarking of gold, following the procedure prescribed in the method IS 1418: 2009 (Assaying of Gold in Gold Bullion, Gold alloys and Gold Jewelry/Artefacts: Cupellation- Fire Assay Method.)

There are 923 recognized Gold Assaying and Hallmarking facilities in India. Highest number of such facilities is in Southern region (312 Nos), followed by Western Region (203 Nos), Eastern Region (181) Central Region (133) and Northern Region (94).

3.0 Gold Assaying Process:

Hallmarking of jewellery/artefact is done in BIS certified facilities/centres, which acts as testing laboratories. These hallmarking facilities/centres/labs are located inside city areas or in busy commercial or business complexes nearby the jewellery manufacturing hub/markets**.**

Assaying is the technical term used for the quantitative chemical analysis of precious metals. In context of Gold Jewellery, assaying means determination of gold in the jewellery/article. The steps involved in **Gold Assaying process** are as follows:

i. **Reception Section**: The process starts from reception. Jewelry are received from different parties i.e. jewelers and are sorted as per their purity claimed by the party and after acceptance, the jwellery are sent for Assaying.

ii. **X-ray Fluorescence (XRF) Section**: After receiving the jewellery sample, the fineness (purity as declared by customer) of the samples are verified by the XRF machine by comparing with the reference material.

iii. **Melting Section:** The accepted samples (Jwellery/artefacts) are cut/drilled in the defined quantity as per BIS guidelines and these drilled/cut piece of sample is then homogenised in melting furnace in graphite crucibles.

iv. **Sample preparation:** The homogenized sample is weighed and other metals i..e. silver and copper is mixed with the homogenised sample and put in lead foil, which is then assayed . Out of several techniques available for assaying precious metals, Fire Assaying is one of the oldest and most reliable methods for the quantitative analysis of gold and silver.

v. **Assaying section (Fire Assay Test):**

As per the standard IS 15820:2009, Assay and Hallmarking of gold is done by the fire assay test as per the method IS 1418: 2009 (Assaying of Gold in Gold Bullion, Gold alloys and Gold Jewelry/Artefacts). In this test, magnesia or calcium phosphate cupels, parting acids (Nitric acids of specific gravity 1.2 & 1.3 g/cm^3), lead foil, precious metals (silver) and other metals like copper are used. The fire assay method is based on the principle of removal of all base metals like lead, copper, etc, present in the sample from noble metals like gold and silver through the process of cupellation and Parting.

Cupellation. In this process samples are kept in cupels for cupellation inside the muffle furnace for 25 min at 1100°C. During the process, lead is oxidised into lead oxide & emitted in the form of fumes, whereas other impurities along-with lead is absorbed in cupels.

Parting: Once cupellation is completed, a gold and silver alloy in the form of bead is obtained. Separating silver from gold by selectively dissolving silver-gold alloy in Nitric acid, is known as parting.

4.0 Sources of Environmental pollution associated with Fire Assay Procedure and Environmental issues of Hallmarking Centres:

Main sources of pollution in Fire Assay Testing and other environmental issues associated with hallmarking centres are as under:

a) Air Pollution:

Lead oxides and Nitrous fumes are generated during cupellation and parting acid treatment respectively. These fumes, if inhaled may pose a health hazard to personals/workers involved in assaying, if not addressed properly.

To control the emissions, fume extraction system is installed and the fumes generated are sucked through suction hood and exhausted fumes are scrubbed by sprinkling of water. The scrubbed water is collected and the recirculate back in the process.

b) Water Pollution

As such there is no usage of water in the process, however the scrubbed water is generated from scrubbing operations during fume extractions. Though the scrubbed water is recycled and recirculated in the process, but over a period of time it is discharged which contain lead as contaminant.

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c) Hazardous waste:

During the process of cupellation, Cupels become contaminated due to the absorption of lead and other heavy metals. Used/Spent cupels bearing lead

and scrubbed water containing residues of lead are the hazardous wastes generated during fire assay posing risk to the environment.

The spent acids generated during parting process are also hazardous waste generated in the fire assay test. The parting process involves boiling of a metal mixture (Gold & Silver) with parting acid (Conc. Nitric acid) to remove the silver. In this process silver present in the metal gets dissolved with nitric acid leaving only gold in its purest form. After recovering dissolved silver from acid, the spent parting acid (Conc nitric acid) is generated which is highly acidic and may adversely affect the receiving environment, if discharged without proper neutralization and treatment. The quantity of nitric acid used in the process is approximately 0.5 litres/assaying and on average daily spent acid generation is 1.0 lit/day. Spent acid has pH about 2.0. **S**pent acid generated is collected in the small container (20-25 littres) to recover silver.

5.0 Environmental Guidelines:

Environmental Guidelines for "Environmental Guidelines for Gold Assaying and Hallmarking Centres"

1. The emissions from cupellation and parting process should be channelized through a well-designed suction hood and duct arrangement system to control lead and nitric acid fumes.

2. The extracted fumes from cupellation and parting should be scrubbed by installing well designed scrubbing system for removing the pollutants from the exhausted air & discharged through appropriate stack as per SPCBs consent conditions.

3. The adequacy/efficiency of the Scrubber system installed need to be verified by the SPCBs or through Expert institutions.

4. The spent acid generated from parting acid should be sent to TSDF or neutralized before its disposal. These Hallmarking centres should have facilities of pH testing like litmus paper, pH meter to check that the spent acid is neutralized.

5. The Spent cupels/scrubbed water containing lead should be sent to TSDF or to the authorized registered lead recyclers dealers.

6. Manifest/records should be maintained for storage and disposal of spent acid/cupels/scrubbed water residue generated during the process.

7. Proper personal protection equipment's such as Face Shields, Helmets, Acid Gloves, First Aid Box, etc. must be used by the personals carrying out fire assay & parting test.

8. Good housekeeping should be maintained by frequent and regular cleaning of the assay lab, preventing lead dust from accumulating on laboratory surfaces.

9. All the gold assaying and hallmarking centers shall obtain necessary Consents under the provisions of Water (Prevention and Control of Pollution) Act, 1974 & Air (Prevention and Control of Pollution) Act, 1981 & Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016 from the concerned State Pollution Control Boards / Pollution Control Committees.

10. The Gold Hallmarking Assaying facilities/Centres should be established as per the siting policies/guidelines of local administration.

11. The Blood test of worker for lead, should be done once in a year who has worked for at least 6 months in such facility.

12. BIS may explore new alternate instrumental methods like Spark or Arc OES with low pollution foot print for assaying of Gold.

13. BIS may also make mandatory to have a copy of consents issued by SPCBs/PCCs under Water Act 1974 & Air Act 1981 and Authorization certificates while issuing the BIS certificates.

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